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**Notes:**

- Untranslatable words are replaced with asterisks (\*\*\*\*).
- Texts in the figures are not translated and shown as it is.

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## FULL CONTENTS

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### Claim(s)]

Claim 1] In the effect grant equipment which gives and outputs sound effects to input sound by executing a microprogram A signal conditioning means by which two or more microprograms can be executed within the limits of the capability of a self-means, A level setting means to set up the level of the sound effects which have a handler and are given to input sound in said signal conditioning means for every microprogram according to the contents of operation of said handler, It is effect grant equipment with which the control means which controls said signal conditioning means according to the contents of a setting of said level setting means is provided, and said signal conditioning means is characterized by for the level of sound effects not executing the microprogram of 0, but the level of sound effects executing microprograms other than zero.

Claim 2] Provide a memory means by which the microprogram of the number which can be performed with said signal conditioning means is memorizable, and [ said control means ] While the level of sound effects eliminates the microprogram newly set to 0 from said memory means and securing a free area It is effect grant equipment according to claim 1 which the free area of said memory means is made to memorize the microprogram with which the level of sound effects newly became except zero, and is characterized by said signal conditioning means executing all the microprograms memorized by said memory means.

Claim 3] Provide a memory means by which all the microprograms to be used are memorizable, and [ said signal conditioning means ] Effect grant equipment according to claim 1 characterized by for the level of sound effects executing the microprogram of 0 among [ no ] the microprograms memorized by said memory means, but the level of sound effects executing microprograms other than zero.

Claim 4] Claim 1 characterized by providing a notice means to notify of the load concerning said signal conditioning means, or 3 -- effect grant equipment given in either.

Claim 5] It is a program for controlling the signal processor which gives sound effects to input sound by executing two or more microprograms within the limits of the capability of self-equipment. The record medium characterized by the level of sound effects recording the program which makes a signal processor execute only microprograms other than zero while changing the level of the sound effects given in a signal processor according to directions of a user.

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## Detailed Description of the Invention]

0001]

Field of the Invention] This invention relates to the record medium which recorded the program for controlling the effect grant equipment which gives and outputs sound effects (effect) to input sound, and this equipment by executing two or more microprograms within the limits of the capability of self-equipment.

0002]

Description of the Prior Art] In the effect grant equipment which gives and outputs desired sound effects to input sound from before DSP (digital signal processor: digital-signal-processing equipment) which processes and outputs an input signal by repeating and executing a microprogram in sampling period of an input signal is used. Generally such DSP has the micro program memory which stores a microprogram, the wave operation part which processes and outputs an input signal by executing this microprogram, and the control register which stores data required for execution of the microprogram concerned etc.

0003] Moreover, two or more microprograms are stored in micro program memory. The multi-microprogram DSP with which a wave operation part carries out parallel execution of the microprogram of these plurality (henceforth) multi-MP-DSP -- saying -- the adopted effect grant equipment is also developed, with such effect grant equipment, the input signal of a multiple channel can be alike, respectively, it can receive, and desired sound effects can be given and outputted.

0004]

Problem to be solved by the invention] By the way, it is necessary to execute two or more microprograms within the sampling period of an input signal in multi-MP-DSP. On the other hand, although the sampling frequency of an input signal changes with quality needed, it is usually set as 4.1kHz to acoustic signals, such as tone. If the number of steps of one microprogram is set to 128 here, in order to execute one microprogram in a sampling period The operation clock frequency of the wave operation part of DSP must be more than  $44100 \times 128 = 5644800$  [Hz], and in order to execute n microprograms within a sampling period, the wave operation part which operates on the frequency n times the frequency of above-mentioned is needed.

0005] In addition, multi-MP-DSP is equipped with two or more blocks for executing one microprogram, and each block operates independently. Therefore, as long as these are assigned to a separate block even if the contents of two or more microprograms executed are the same when considering the throughput of DSP, it is necessary to count each separately. That is, it does not need to be concerned with the difference of the microprogram to be used, but it is necessary to make an operation clock frequency into n times. Of course, if two or more wave operation parts are prepared in DSP and it is made to perform parallel processing, the operation clock frequency needed can be controlled low, but it is the same as that of \*\*\*\* to need n-time-as many throughput as this as compared with the run time of one microprogram.

0006] the case where the sampling frequency of an input signal is 44.1kHz under the present circumstances -- the microprogram which can be executed in one multi-MP-DSP -- at most -- it is some and a number exceeding this maximum of microprograms cannot usually be assigned to each block of multi-MP-DSP. Therefore, even if it is the case where only the sound effects below the above-mentioned maximum are simultaneously used only not only in when using much sound effects simultaneously

When the total of the sound effects to be used by the time of termination from the reproduction start time of tone exceeded the maximum concerned, there was a fault that no sound effects could be assigned in advance.

0007] This invention was made in view of the situation mentioned above, and aims at offering the record medium which recorded the program for controlling the effect grant equipment which can set up such sound effects at once, and this equipment.

0008]

Means for solving problem] In order to solve the above-mentioned technical problem, [ effect grant equipment according to claim 1 ] In the effect grant equipment which gives and outputs sound effects to input sound by executing a microprogram A signal conditioning means by which two or more microprograms can be executed within the limits of the capability of a self-means, A level setting means to set up the level of the sound effects which have a handler and are given to input sound in said signal conditioning means for every microprogram according to the contents of operation of said handler, The control means which controls said signal conditioning means according to the contents of a setting of said level setting means is provided, and said signal conditioning means is characterized by for the level of sound effects not executing the microprogram of 0, but the level of sound effects executing microprograms other than zero.

0009] Moreover, in a thing according to claim 1, provide effect grant equipment according to claim 2; and a memory means by which the microprogram of the number which can be performed with said signal conditioning means is memorizable [ said control means ] While the level of sound effects eliminates the microprogram newly set to 0 from said memory means and securing a free area The free area of said memory means is made to memorize the microprogram with which the level of sound effects newly became except zero, and said signal conditioning means is characterized by executing all the microprograms memorized by said memory means.

0010] Furthermore, provide effect grant equipment according to claim 3, and a memory means by which all the microprograms to be used are memorizable in a thing according to claim 1 [ said signal conditioning means ] It is characterized by for the level of sound effects executing the microprogram of among [ no ] the microprograms memorized by said memory means, but the level of sound effects executing microprograms other than zero. moreover, effect grant equipment according to claim 4 -- claim 1 or 3 -- it is characterized by providing a notice means to notify either of the load concerning said signal conditioning means in the thing of a description.

0011] Moreover, a record medium according to claim 5 is a program for controlling the signal processor which gives sound effects to input sound by executing two or more microprograms within the limits of the capability of self-equipment. While changing the level of the sound effects given in a signal processor according to directions of a user, the level of sound effects is characterized by recording the program which makes a signal processor execute only microprograms other than zero.

0012]

Mode for carrying out the invention]

: Below the composition of an embodiment explains one embodiment of this invention with reference to Drawings. Drawing 1 is the block diagram showing the composition of the electrophone which has effect grant equipment by one embodiment of this invention, and is set to this figure. The MIDI interface 1 which 1 outputs and inputs MIDI (Musical Instrument Digital Interface) data, A panel switch (panel W) for a user to perform a setup, adjustment, etc. of various kinds of effects (sound effects) 2, the drop

with which 3 consists of a liquid crystal panel, an LED (Light Emitting Diode) sequence, etc., and 4 are disk drives. Although the disk 4a which this drive 4 stores may be the record medium of fixed mount types, such as a hard disk, and you may be a portability [ , such as a floppy disk, ] type record medium, in this embodiment, it shall be a portability type record medium.

[013] ROM which stored a microprogram, control data, etc. for the timer by which 5 supplies an operation clock to each part of this electrophone, and 6 to give the control program and various kinds of effects (sound effects) which control this whole electrophone (read-only memory), CPU (central processing unit) in which 7 executes the above-mentioned control program, and 8 are RAM (random access memory) written by reading and CPU7, and [ CPU7 ] While controlling each part 1-6, and 8 mentioned above by executing the above-mentioned control program, each part 10, 11, 15, and 16 mentioned later is controlled.

[014] 9 is the waveform memory which can be written and has the field for memorizing the data point or predetermined time (phrase wave), while rewriting and having an impossible field which memorized the data point of the standard tone set up beforehand. The write-in circuit where 10 writes the data point which CPU7 read in the drive 4, and the data point supplied from a mixer 15 in the waveform memory, 11 reads a data point from the waveform memory 9 according to the directions from CPU7. It is the sound source which generates the acoustic signal according to the data point and the directions (MIDI data / loop reproduction) from CPU7 which were read, and simultaneous generation of the acoustic signal of a multiple channel (this embodiment a maximum of 64 channels) is possible. Moreover, 12 is access control which manages access to the waveform memory 9 from the write-in circuit 10 and a sound source 11.

[015] The external wave form input terminal into which 13 inputs an acoustic signal from the exterior of this electrophone, The A-D converter which changes into a digital signal the acoustic signal of an analog into which 14 was inputted from the external wave form input terminal, The mixer which 15 can compound [ an input and ], and 16 are DSP (digital signal processing circuit) which gives and outputs an effect to the acoustic signal included in the synthetic output of a mixer 15. [ of the acoustic signal of a multiple channel ] The acoustic signal of 64 channels with which a mixer 15 is supplied from a sound source 11 according to directions of CPU7, The acoustic signal of one channel from the external waveform input terminal 13 and the acoustic signal of the multiple channel (alpha channel) supplied from DSP16 are inputted. Two or more mixing processings in which it became independent about the input of these multiple channels (this embodiment 64+1+ alpha channel) are performed by time sharing, and the acoustic signal of the multiple channel obtained by the mixing processing concerned is supplied independently to two or more inputs of DSP16, and the input of the write-in circuit 10, respectively. In addition, the acoustic signal supplied to the write-in circuit 10 from the mixer 15 is written in the waveform memory 9 as the above-mentioned "data point."

[016] On the other hand, to the acoustic signal included in the signal supplied from a mixer 15, DSP16 execute an internal microprogram, and give and output the effect expressed with the microprogram concerned. When giving two or more effects within DSP that the output destination change (a mixer 15 or D-A converter 17) of these DSP16 can be set up with a microprogram It is also realizable to pass the input (acoustic signal) to a certain effect to DSP16 from a mixer 15, to compound the acoustic signal which has returned from DSP16 to the mixer 15 with other acoustic signals, to pass DSP16 again, and to consider it as the input to the following effect.

[017] By this embodiment, using the feature mentioned above, actually [ a mixer 15 ] According to

directions of CPU7, it is inputted from the external input terminal 13, the data point of predetermined time (several seconds - tens of seconds) is once started from the acoustic signal returned via DSP16, and the function to supply the circuit writing 10 by making this into a phrase wave is prepared. In addition, a "phrase wave" is a wave "was performed" already, for example, is obtained by recording an ARUPEJIO performance of the guitar for two vibrant tunes, the percussion performance for four vibrant tunes, etc. In this embodiment, the data point for predetermined time (1 - number vibrant tune) from drive 4 or a mixer 15 is adopted as a phrase wave. Moreover, in "loop reproduction", only arbitrary time repeats the above-mentioned phrase wave, and it reproduces. Since this range to repeat (loop) is the length of a phrase wave, i.e., the length of a vibrant tune "performed", only comfortable arbitrary time can continue the performance (for example, ARUPEJIO performance of the guitar for the two above-mentioned vibrant tune) concerned. In this embodiment, the control sequence which realizes time change of a phrase wave, the performance data for an automatic performance and volume, the normal position, etc. is mentioned as data which is the target of this loop reproduction.

[018] As mentioned above, a connection state can be arbitrarily changed by setting up a mixer 15 suitably between each input/output of two or more effects performed by DSP16, the input from A-D converter 14, and the output to the write-in circuit 10. Therefore, while being able to change the combination of an effect and an acoustic signal freely, flexibility of an addition/deletion of an effect can be made high. Moreover, in drawing 1, 18 is a sound system which has amplifier, a loudspeaker, etc., and is pronounced according to the acoustic signal supplied from D-A converter 17.

[019] Drawing 2 is the figure showing panel SW2 of this electrohone, and the appearance composition of the important section of a drop 3. A part pad for 21a-21j to specify a part in drawing 2, A part knob or 22a-22j to set up the level of the effect given to a corresponding part and 23 are the switches for edit or setting up the kind of the data assigned to each part or effect, and perform processing to which CPU7 is equivalent according to these contents of operation. In addition, suffix a-j of the sign given to the above-mentioned part pad and the part knob assumes that the parts 1-10 who mention later, respectively are supported.

[020] Here, the outline of the processing performed in relation to operation of above-mentioned panel W2 is described. In addition, unless it shows clearly in particular, the subject of the processing described below shall be each part controlled by CPU7 and CPU7. The effect which should be given for every part according to operation of the switch 23 for edit is chosen, and the level of the effect of the part who corresponds according to operation of a part knob, and "effective"/"invalid" of the effect concerned are set up. moreover, the data (performance data --) assigned to the part pad concerned according to the depression of a part pad A phrase wave or a control sequence is reproduced, processing of the effect which has become among two or more effects "effective" set up for every part is performed to the tone of each part generated by this, and the effect concerned is given to the tone concerned.

[021] In addition, when the automatic performance which the part pads 21a-21d are pads for automatic performances, and followed performance data according to operation of the pad concerned is performed, one generation according to the playing event reproduced by this automatic performance is performed to a sound source 11 using the data point of the standard tone of the rewriting impossible field of the waveform memory 9. Moreover, the part pads 21e-21h are pads for phrase samplers, and the data point (phrase wave) of the rewriting feasible region of the waveform memory 9 is assigned. In addition, it is selectable in the performance data assigned with each above-mentioned part pads 21a-21h, or loop reproduction of a phrase wave.

022] Furthermore, it is selectable in loop reproduction of the control sequence which the master is assigned to the external input and the part pad 21j at the part pad 21i, and was assigned with both pads. In addition, the effect concerned will be given to all the parts, if the master here means all the parts' being inputted into DSP16 and an effect is set as the part pad 21j.

023] Moreover, in drawing 2, the display surface as which 24 displays an operating state, the contents of a setting, etc. of this electrohone; and 25 are indicators in which the ratio (load, the amount used) of used capability to the maximum capacity of DSP16 is shown visually. Of course, although the indicator which ON and OFF of handlers, such as a volume knob with which electrohone is generally equipped for a power supply is shown is formed in panel SW2 and a drop 3, the illustration and explanation are omitted here for complicated-sized evasion of explanation.

024] Drawing 3 is the figure simplifying and showing the composition of DSP16 which this equipment has. The CPU interface with which 161 receives the microprogram transmitted from CPU7, control data, etc. in this figure, 162 is micro program memory which stores the microprogram supplied through the CPU interface 161, and has a storage capacity corresponding to the number of operation blocks of 1 sampling period (the number of clocks of the command executed). This micro program memory 162 can divide an internal storage area into two or more blocks, and can also specify different size for every block in this division. Of course, division that each block serves as the same size is also possible. Moreover, this DSP16 are constituted so that the input (part) which is the target of the microprogram stored in each above-mentioned block can be altogether set as one either.

025] Moreover, the control register which stores the control data which 163 received through the CPU interface 161, The wave input section for 164 to input the data point by which time division multiplex was carried out, The wave output section for 165a and 165b to output a data point and 166 are wave operation parts. Based on the above-mentioned microprogram and the above-mentioned control data, various data processing (sum-of-products data processing etc.) is performed to the data point inputted from the wave input section 164, or the past data point, and the processing result is supplied to the wave output section 165a or 165b. Moreover, 167 is data memory written by reading and the wave operation part 166, and is used at the time of data processing of the effect which requires the data point of the past, such as RIBABU, etc.

026] In addition, the command the above-mentioned microprogram instructs various kinds of data processing performed by the wave operation part 166 to be, Directing the read-out writing processing of data performed between the wave operation part 166 and data memory 167, the above-mentioned control data specifies the address of the writing/read-out to the constant and data memory 167 of data processing performed by a wave operation part. These microprograms and control data are read one by one synchronizing with the operation clock of a system, and are supplied to the wave operation part 166. In addition, the frequency of the operation clock of a system is set up highly enough as compared with the sampling frequency (here 44.1kHz). (For example, in this embodiment, it carries out by 512 times the sampling frequency) and this DSP16 can execute two or more microprograms for every sampling period. However, the sum total of the number of steps of two or more executable microprograms concerned is 12 or less steps simultaneously.

027] Drawing 4 is the block diagram showing the working example of logical construction of this equipment. In this figure, it considers that the part pads 21a-21i are the 1-9th part pads, and the part and effect which were assigned to these are made into the part 1 - the part 9, the effect 1 - the effect 9. In the example shown in this figure, although effects 1, 5, 6, and 9 are set up to parts 1, 5, 6, and 9, the effect is

not assigned to other parts. Moreover, about parts 1 and 6, although effects 1 and 6 are set up, the level of the corresponding part knobs 22a and 22e is set as 0, and serves as through (invalid) in fact.

0028] The data point obtained by giving RIBABU after giving and compounding the effect corresponding to the past data point in the example of this figure, After compounding each data point obtained by giving the effect corresponding to each present data point, it has composition which gives and outputs an equalizer (EQ) effect. That is, although it has logically composition (MIX1, MIX2) which uses two mixers, having realized using one mixer is as having mentioned above in fact.

0029] 2: Explain operation of an embodiment, next operation of the electrophone of composition of having mentioned above. Drawing 5 is a flow chart which shows fundamental operation of this electrophone, and if the power supply which is not illustrated is switched on as shown in this figure, CPU7 will perform initial setting (step SA1) and it will repeat the processing after step SA2 henceforth. At Steps SA2 and SA3, CPU7 return to processing of step SA2, when it judges whether the factor (event) resulting from operation of a user etc. was detected, and the factor was detected (step SA2, step SA3) and a factor is not detected here. On the contrary, when a factor is detected, CPU7 specify the kind of factor (step SA4), they perform processing according to the specified kind (step SA5, SA6, SA7), and return to processing of step SA2.

0030] Although there are a MIDI entry of data of MIDI interface 1 course, operation of Panel SW, and other factors as a factor currently assumed here Since operation at the time of generating of other factors is the same as that of the existing electrophone, it omits explanation, and it explains operation at the time of operation at the time of a MIDI entry of data, and operation of Panel SW hereafter. First, operation at the time of a MIDI entry of data is explained. In this electrophone, parts 1-10 support one channel - ten channels of MIDI as it is. In one channel - 4 corresponding to an automatic performance part, tone generation by the data point of the above-mentioned standard tone is performed according to the input or note-on of MIDI data etc. Moreover, the MIDI data inputted into this part can be recorded, and it can memorize to RAM8 as performance data. On the other hand by five channels - 8 corresponding to a phrase wave part, and 9 or 10 channels that remain, tone generation according to note-on etc. is not performed. Moreover, the MIDI data which expresses operation of a part pad with channels 1-10 can be inputted, and CPU7 perform processing equal to the corresponding part pad having been performed according to the input concerned. In addition, since it is the same as that of the existing electrophone about control of others about MIDI data, the explanation is omitted.

0031] Next, operation at the time of operation of Panel SW is explained with reference to drawing 6 (a) drawing 6 (c), and drawing 7. Drawing 6 (a) - drawing 6 (c), and drawing 7 are flow charts which show operation of this equipment at the time of the operation event generation of Panel SW, drawing 6 (a) and drawing 6 (b) show the processing before a performance start, and drawing 6 (c) and drawing 7 show the processing under performance, respectively.

0032] Operation at the time of a part performance selection event generation, i.e., inside of the switch 3 for edit, in drawing 6 (a), As operation when the switch for assigning data (performance data, a phrase wave, or control sequence) is pushed is shown to each part and it is shown in this figure CPU7 input the parameter j which expresses the number (part number) i of the part who assigns data, and the contents of the data to assign first (step SB1). CPU7 make the number which the part pad pushed beforehand was given the part number i, and, specifically, they input the number given to the pushed switch 23 for edit as a parameter j. And CPU7 assign the data expressed with the parameter j to the part



namely, part corresponding to the part pad pushed beforehand) to whom it is expressed with the part number i (step SB2). Namely, in parts' 1-4 automatic performance part [ one automatic playing data ] In parts' 5-8 phrase sampler part, one control sequence for [ in one control sequence for single part control one phrase wave ] all the part control at a part's 10 master part is chosen according to the parameter j, respectively by a part's 9 external input part. In addition, performance data and a control sequence shall be beforehand stored in ROM6 or RAM8. Thus, CPU7 perform the part effect selection event processing shown in drawing 6 (b) to the part to whom data was assigned. However, it is not necessary to be necessarily such an order, and after performing processing shown in drawing 6 (b), you may be made to perform processing shown in drawing 6 (a).

0033] If the switch for assigning an effect to each part among the switches 23 for edit is pushed as shown in drawing 6 (b), CPU7 will input the parameter j showing the part number i of the part who is going to set up an effect, and the contents of the effect to set up (step SC1). And CPU7 set up the effect expressed with the parameter j to the part to whom it is expressed with the part number i (step SC2). In this way, the information about the set-up part is memorized by RAM8. In addition, as shown in drawing 4, the selection in a setup for every part of "not choosing an effect" is also possible.

0034] When one of part pads is pushed during a performance, as shown in drawing 6 (c) on the other hand, [ CPU7 ] The velocity (depression speed) v of the part number i given to the part pad concerned and the part pad concerned is inputted (step SD1). The performance data assigned to the part henceforth, the part i) to whom it is expressed with the part number i, a phrase wave, or a control sequence is reproduced (step SD2). Under the present circumstances, the amount of reproduced sounds is controlled by Velocity v. here -- processing of step SD2 -- a case -- dividing -- carrying out -- concretely explaining .

0035] \*\* When an automatic performance part's pad (part pads 21a-21d) is operated, CPU7 start the automatic performance based on the performance data currently assigned to the operated pad. That is, the timer for time counting is operated and the playing event of each timing specified by REYURESHON in performance data is reproduced one by one. And according to the reproduced playing event, pronunciation control of a sound source 11 and control of a mixer 15 and DSP16 grade are performed.

\* When the pad (part pads 21e-21h) of the part of a phrase wave is operated, CPU7 direct the reproduction start of the data point of a phrase wave currently assigned to the operated pad in a sound source 11.

\* When the pad (part pads 21i and 21j) of an external input part or a master part is operated, CPU7 start automatic Control Division based on the control sequence currently assigned to the operated pad. That is, the timer for time counting is operated and the control event of each timing specified by REYURESHON in a control sequence is reproduced one by one. And control of mixer 15 and DSP16 is performed according to the reproduced control event. In addition, it can be set up whether loop reproduction is performed for every part, and automatic playing data, a phrase wave, or a control sequence is repeatedly reproduced in the part by whom loop reproduction was set up.

0036] Moreover, if one of part knobs is operated during a performance, as shown in drawing 7, CPU7 will input the set point k of a level which the part number i corresponding to the part knob concerned and the part knob concerned express (step SE1). Next, CPU7 judge whether the effect is assigned to the part i concerned with reference to the memory content of RAM8 (step SE2). CPU7 will end this



rocessing, if the above-mentioned judged result is "NO", and if they are "YES", they will judge whether the above-mentioned set point  $k$  is 0 (step SE3).

0037] When the judged result of step SE3 is "YES" (i.e., when it is  $k=0$ ), CPU7 continue and they judge whether the effect to the part  $i$  concerned is effective (step SE4). With this equipment, since it is set to  $F_i=1$ , and it is set to  $F_i=0$  in being invalid when Part's  $i$  effect is effective, the above-mentioned judgment is realized by judging whether  $F_i$  is 1. CPU7 end this processing, when the judged result of step SE4 is "YES" (i.e., when the set point of the level of the effect which was invalid from the first is extracted to 0). In "NO" (i.e., when the set point of the level of an effective effect is extracted to 0), processing described below is performed.

0038] In step SE5, CPU7 change the control data corresponding to Part  $i$  so that Part's  $i$  effect level may be extracted to 0, and they transmit to DSP16. And the field of the micro program memory 162 which the effect set as Part  $i$  was using is released (step SE6), the display of an indicator 25 is updated (step SE7), zero is substituted for  $F_i$  (step SE8), and processing is ended.

0039] In addition, CPU7 always grasp the number and each size (the number of steps) of a microprogram which are set as DSP16. The contents of a display of an indicator 25 are determined by comparing the total value of this size with the number of the operation clocks for every sampling period which can set up DSP16 (the number of the maximum steps). Moreover, processing of step SE5 is the processing prepared in order to prevent that a noise occurs, when suspending Part's  $i$  effect processing.

0040] On the other hand when the judged result of step SE3 is "NO" When it judges whether CPU7 are  $i=1$  (step SE9) and this judged result is "YES", namely, when the set point of the level of an effective effect from the first is changed in addition to zero According to the installation value  $k$ , the mixing ratio control data corresponding to Part  $i$  is changed so that the level of Part's  $i$  effect may be changed, and transmits to mixer 15 or DSP16 (step SE10), and this processing is ended. In addition, the level of each effect is controlled by the mixing ratio of a mixer 15, and the coefficient of DSP16.

0041] on the contrary, when the judged result of step SE9 is "NO" (i.e., when the set point of the level of an invalid effect is changed in addition to zero) CPU7 check the free area of the micro program memory 162 (step SE11). [ judge whether there is only any free area (field for carrying out additional memory of the one microprogram) which can realize the effect set as Part  $i$  (step SE12), and ] if this judged result is "NO" It displays "The opening of DSP is lacking" on a drop 3, and this processing is ended (step SE13).

0042] On the other hand when the judged result of step SE12 is "YES" CPU7 transmit the microprogram for realizing the effect concerned to DSP16, and they make the micro program memory 162 carry out additional memory (step SE14). The display of an indicator 25 is updated (step SE15), one is substituted for  $F_i$  (step SE16), the level of the new effect realized with the microprogram concerned is changed according to a set point  $k$  (step SE10), and processing is ended.

0043] Next, the concrete example of operation by a user is explained with reference to drawing 4.

However, the storage capacities of the micro program memory 162 shall be 512 steps here. Moreover, IBABU of 256 steps, the effect 5 of 128 steps set as the part 5, and the effect 9 of 96 steps set as the part 9 consider it as a working thing among two or more effects set up.

0044] When a user tries to operate a part knob and raise the set point of the level a part's 6 effect under the situation which shows in drawing 4, for example, the message "the opening of DSP is lacking" is displayed on a drop 3, and the set point of a level cannot be raised. Then, a user chooses an effect (for example, effect 9) unnecessary for the time being, and lowers the set point of the level of this effect to 0.

hereby, the free area of 128 steps is secured to the micro program memory 162, and it becomes storable [ the microprogram of 128 steps which realize the effect 6 set as the part 6 to the field concerned ]. Henceforth, if a user operates the part knob corresponding to a part 6 and raises the set point of the level a part's 6 effect, the microprogram which realizes an effect 6 will be stored in the above-mentioned free area, and an effect will be given to a part's 6 tone in the depth according to the level concerned. In addition, a free area is also securable by, for example, changing into RIBABU of 160 other steps RIBABU of the 256 above-mentioned step chosen now instead of extracting a part's 9 effect and securing a free area. Change of such an effect is realizable with operation of the switch 23 for dit.

[045] 3: According to this embodiment, a number exceeding the capability of DSP of effects can be set up before a performance start for more than the conclusion to have explained. Moreover, since a user can know immediately the load (the amount of DSP used) concerning DSP, the level of an unnecessary effect can be extracted and the throughput of limited DSP can be utilized easily and effectively.

[046] 4: In the embodiment which is a modification and which was mentioned above, although one effect (microprogram) made the target part one or all, you may prepare alternative other than these. Moreover, although the example which sets up one effect for every part was shown, you may enable it to assign two or more effects not only to this but to each part, and may make it set up two or more effects regardless of a part. Moreover, although the depression speed (velocity  $v$ ) of the part pad was inputted, you may make it input with other techniques, and may make it omit the input of Velocity  $v$  itself. Moreover, although the example which applied this invention to Hardware DSP was shown, it cannot be overemphasized that CPU may apply to what is called software DSP that takes over the processing which DSP performs. Furthermore, the function of data memory 167 is prepared in RAM8, and you may make it share RAM8 by CPU7 and DSP16. Moreover, the function of the micro program memory 162 is prepared in RAM8, and you may make it share RAM8 by CPU7 and DSP16. Moreover, capacity of the micro program memory 162 is fully made into size, and you may make it store all the microprograms to be used in DSP16. However, since the number of steps of the microprogram which DSP16 can execute in a sampling period (the number of operation clocks per 1 sampling period) is restricted even in this case, the same control as the embodiment mentioned above is needed. Here, needed control is explained below.

[047] In fundamental processing operation, the microprogram of the part by whom the effect level which is not 0 among all the microprograms memorized by the micro program memory 162 was set up is alternatively supplied to the wave operation part 166 one by one in a sampling period. The judgment of whether there is any opening of operation clocks enough in the bottom of this situation to perform a new effect in a sampling period similarly with having carried out by the above-mentioned step SE12 when it is going to set up the effect level which is not newly 0 is performed. As a result, CPU7 indicates the opening of DSP is "lacking", when there is no opening, and when there is an opening, they direct to start processing operation which includes a new effect to the micro program memory 162.

[048] In addition, what kind of forms, such as a keyboard instrument, a stringed instrument, a wind instrument, and a percussion instrument, may the electrophones which apply this equipment be? Moreover, not only the electrophone having sound source equipment but each may be prepared in another object, and each equipment may be connected using the means of communications of MIDI, various networks, etc. Furthermore, not only the form of electrophone but a general-purpose computer may be made to realize.

0049] Moreover, although the embodiment mentioned above showed the form which ROM is made to memorize a control program, a microprogram, etc., and CPU reads this, and realizes various functions by use \*\*\*\*\* Of course as a storage of application software, you may use storages, such as a magnetic disk, an optical disk, a magneto-optical disc, and semiconductor memory. Under the present circumstances, if a portability type storage is used, it is convenient in the case of update of a control program.

0050] Or a communication interface is prepared and it may be made to perform by downloading a control program, a microprogram, etc. via a communication network. The example which downloads a control program from the network side is given to below. It connects with communication networks, such as LAN (local area network), and the Internet, a telephone line, and the above-mentioned communication interface is connected with a server computer through the communication network concerned. The equipment of a client side transmits the command which requires a program etc. to a server computer through the above-mentioned communication interface and a communication network, when neither a control program nor various microprograms are memorized by the storage which oneself has. If this command is received, a server computer will distribute the demanded data to a client side through a communication network. And download is completed, when the equipment of a client side receives through a communication interface and stores the distributed data in a storage.

0051]

Effect of the Invention] As explained above, since the level of sound effects does not execute the microprogram of 0 but the level of sound effects was made to execute microprograms other than zero, according to this invention, it is not necessary to cleave a signal conditioning means to the sound effects which are not using the capability of a signal processor. Therefore, when there are few sound effects used simultaneously, a number exceeding the capability of a signal conditioning means of sound effects can be set up (Claim 1 -3, 5). Moreover, since it notified of the load concerning a signal conditioning means, the user can set up the level of sound effects so that the load concerned may not exceed the capability of a signal processor (Claim 4).

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### Brief Description of the Drawings]

Drawing 1] It is the block diagram showing the composition of the electrohone which has effect grant equipment by one embodiment of this invention.

Drawing 2] It is the figure showing the appearance composition of the important section of panel SW2 of this electrohone, and the panel drop 3.

Drawing 3] It is the figure simplifying and showing the composition of DSP which this equipment has.

Drawing 4] It is the block diagram showing the example of composition of the sound-effects grant portion of this equipment.

Drawing 5] It is the flow chart which shows fundamental operation of this electrohone.

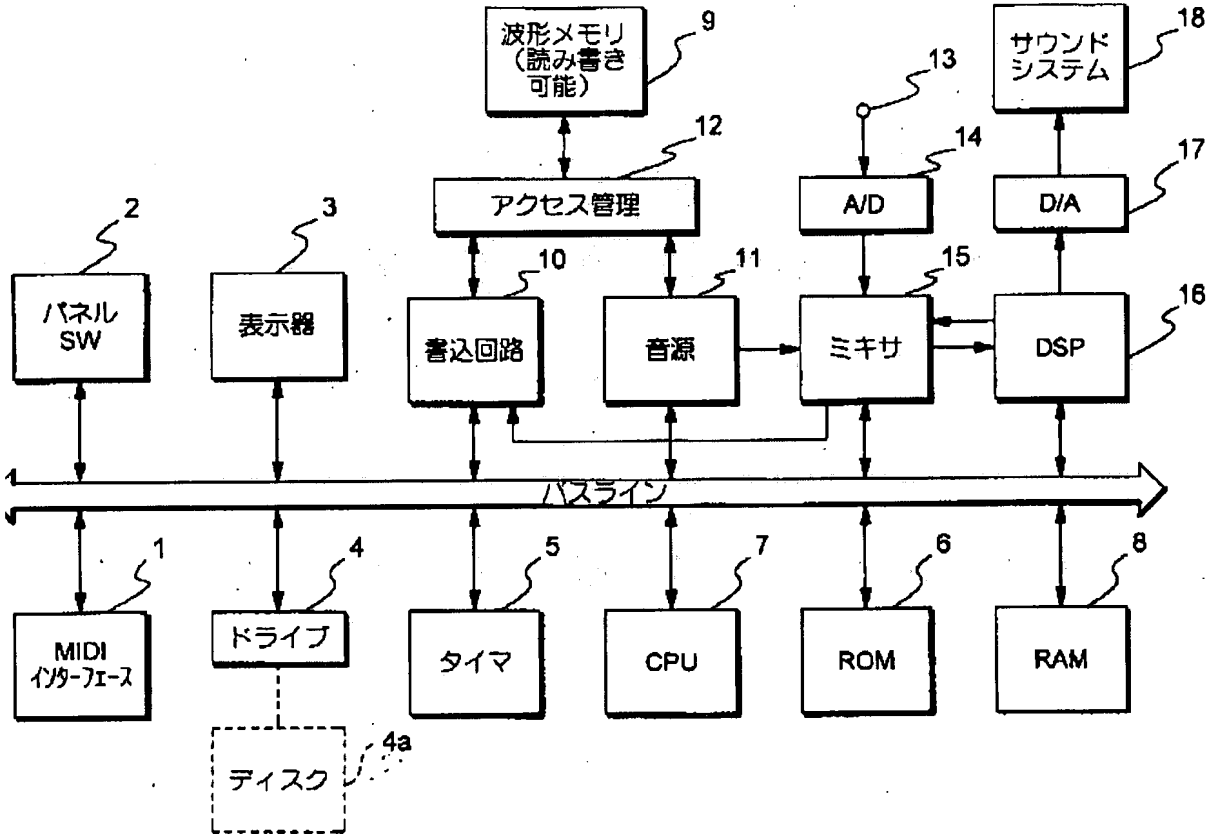
Drawing 6] (a) - (c) is a flow chart which shows operation of this equipment at the time of the operation event generation of Panel SW, respectively.

Drawing 7] Drawing 7 is a flow chart which shows operation of this equipment at the time of the operation event generation of Panel SW.

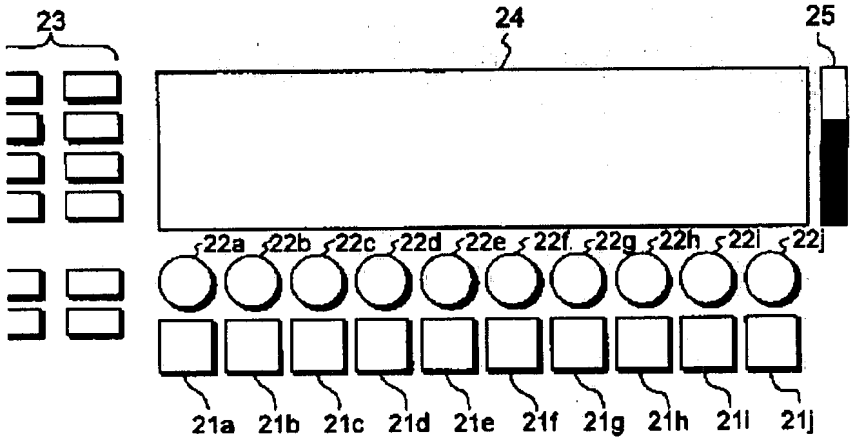
Explanations of letters or numerals]

[ -- ROM, 7 / -- CPU (control means) 8 / -- RAM, 15 / -- A mixer, 16 / -- DSP (a signal conditioning means, a memory means, signal processor) ] -- Panel SW (level setting means), 3 -- A drop (notice means), 5 -- A timer, 6

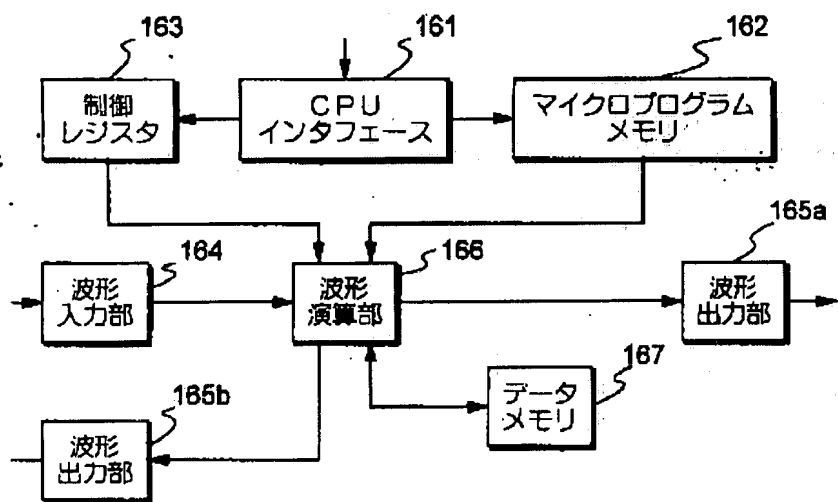
Drawing 1]



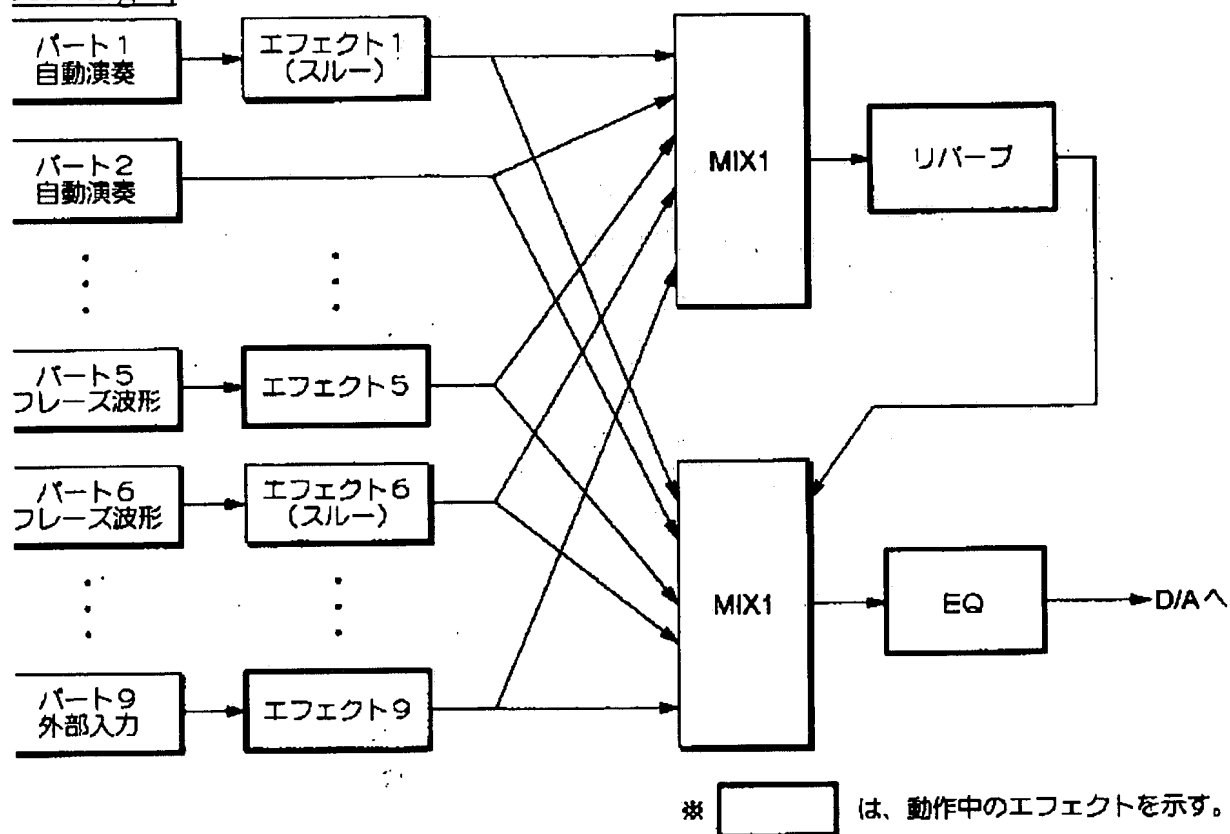
Drawing 2]



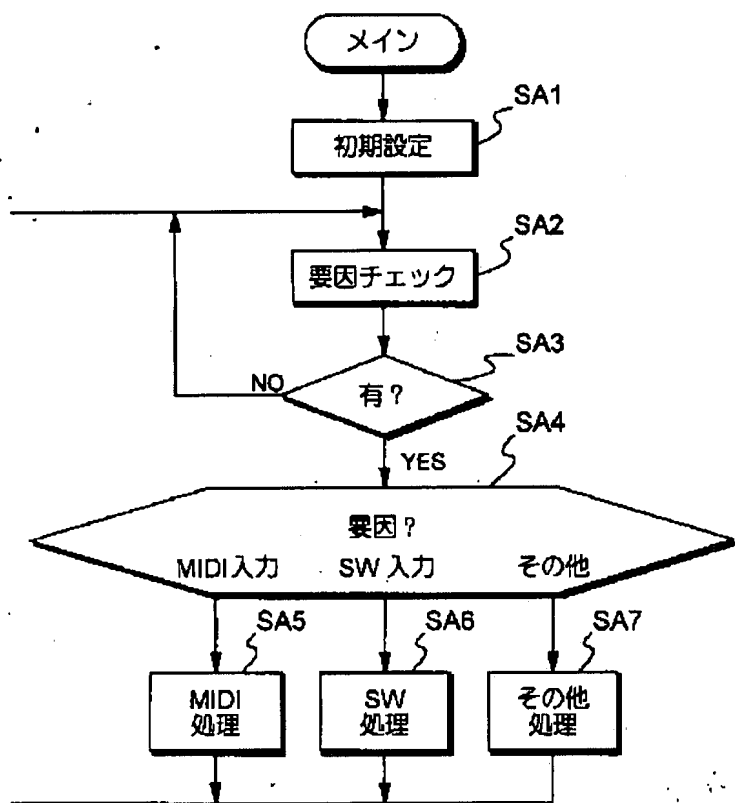
Drawing 3]



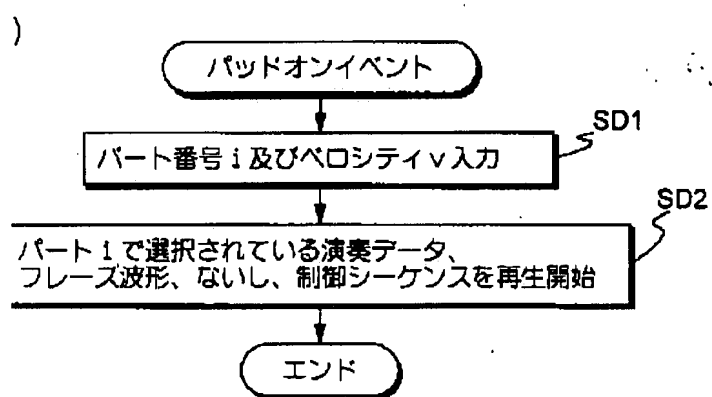
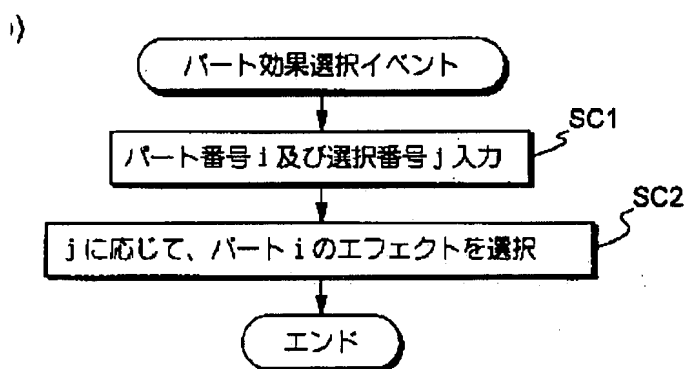
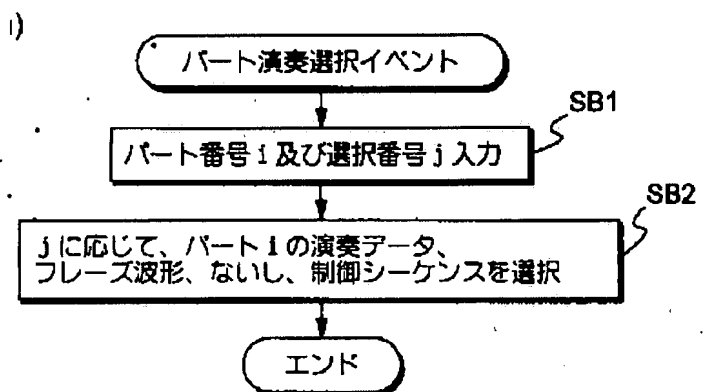
Drawing 4]



Drawing 5]

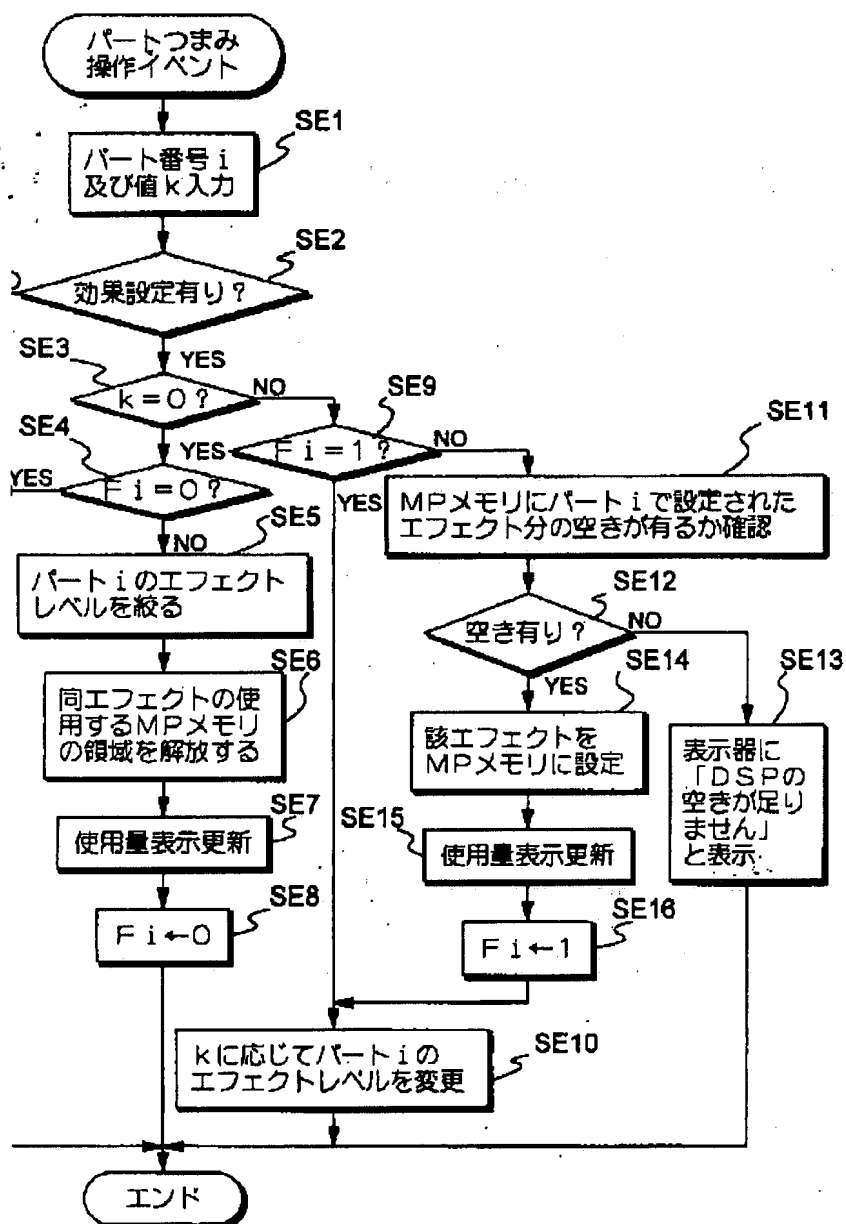


Drawing 6]



Drawing 7]





[translation done.]